SHOULD THE LAW REFLECT THE WORLD?: LESSONS FOR LEGAL THEORY FROM QUANTUM MECHANICS

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I. INTRODUCTION

TRADITIONALLY law and legal theory have been deeply influenced by the reigning models and metaphors of science.[1] Even before the rise of modern science, the metaphysics of the Middle Ages was reflected in the political and legal hierarchy of medievalism.[2] The rise of Newtonian physics in turn influenced the assumptions underlying legal and political documents such as the American Declaration of Independence[3] and the Constitution.[4]

Some sort of linkage between the order of being, or of what sorts of things exist, and how we ought to order our social affairs has traditionally been assumed.[5] The rise of post-Newtonian physics has led scientists and legal theorists to raise the question of this linkage anew.[6] The centerpiece of post-Newtonian physics has been the development of quantum mechanics.[7] This Article seeks to explore the linkage between quantum mechanics and contemporary legal theory.

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1. *See* N. HERBERT, QUANTUM REALITY: BEYOND THE NEW PHYSICS XI (1985); Levit, *Listening to Tribal Legends: An Essay on Law and the Scientific Method*, 59 FORDHAM L. REV. 263, 264 (1989).

2. *See* N. HERBERT, *supra* note 1, at xi.

3. *See id.* at xi-xii.

4. *See* Toffler, *Foreword: Science and Change*, in I. PRIGOGINE & I. STENGERS, ORDER OUT OF CHAOS: MAN'S NEW DIALOGUE WITH NATURE xiii (1984); Tribe, *The Curvature of Constitutional Space: What Lawyers Can Learn From Modern Physics*, 103 HARV. L. REV. 1, 3 & n.5 (1989); Note, *The Scientific Model in Law*, 75 GEO. L.J. 1967, 1987 n.96 (1987).

5. *See* P. FORREST, QUANTUM METAPHYSICS xiii (1988).

6. *See, e.g.*, J. JAUCH, ARE QUANTA REAL?: A GALILEAN DIALOGUE 97 (1973); Jones, *Complementarity as a Way of Life*, in NIELS BOHR: A CENTENARY VOLUME 320, 320 (A. French & P. Kennedy eds. 1985). Among legal theorists, see Scales, *The Emergence of Feminist Jurisprudence: An Essay*, 95 YALE L.J. 1373, 1401 (1986) (quantum mechanics and other developments as showing that "nature is on our side").

7. *See* M. JAMMER, THE PHILOSOPHY OF QUANTUM MECHANICS: THE INTERPRETATIONS OF QUANTUM MECHANICS IN HISTORICAL PERSPECTIVE v (1974). Jammer argues:

> Never in the history of science has there been a theory which has had such a profound impact on human thinking as quantum mechanics; nor has there been a theory which

For the sake of manageability, the focus will be primarily upon relationships between quantum mechanics and three representative schools or movements within contemporary legal theory, specifically, feminist legal theory, the Critical Legal Studies movement, and the economic analysis of law. Each of these three movements is characterized by great internal diversity,[8] just as quantum mechanics is itself subject to a wide range of conflicting interpretations.[9] Therefore, certain lessons may be valid only if we accept some particular interpretation of quantum mechanics, and the lessons from quantum mechanics may apply most usefully only to particular strains of thought within feminist theory, Critical Legal Studies, or the law and economics movement.[10] Quantum theory, however, generally can speak powerfully and evocatively to each of these schools of legal thought.

Before we begin to make good that assertion, certain disclaimers are in order. First, this Article does not argue for the truth or validity of quantum theory, generally or in any particular version. Quantum theory deserves attention because it has been hugely influential.[11] Second, this Article need not endorse or condemn in blanket fashion any of

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> scored such spectacular successes in the prediction of such an enormous variety of phenomena. . . . Furthermore, for all that is known today, quantum mechanics is the only consistent theory of elementary processes.

Id. For an extremely concise formulation of some of the basic elements of quantum theory, most of which will be referred to at various points below, see Albert & Loewer, *Interpreting the Many Worlds Interpretation*, 77 SYNTHESE 195, 195 (1988).

8. For references to the diversity of feminist scholarship, see Minow, *Beyond Universality*, 1989 U. CHI. LEGAL F. 115, 134-35; Rhode, *Feminist Critical Theories*, 42 STAN. L. REV. 617 (1990) (referring to both feminist and Critical Legal Studies); Sunstein, *Introduction: Notes on Feminist Political Thought*, 99 ETHICS 219 (1989). On the diversity of Critical Legal Studies, see M. KELMAN, A GUIDE TO CRITICAL LEGAL STUDIES 2 (1987); *Critical Legal Studies Symposium*, 36 STAN. L. REV. 1 (1984); Herzog, *As Many As Six Impossible Things Before Breakfast*, 75 CALIF. L. REV. 609, 610 (1987); Rhode, *supra*; Solum, *On the Indeterminacy Crisis: Critiquing Critical Dogma*, 54 U. CHI. L. REV. 462, 462, 463 & n.2 (1987). On the law and economics movement, see Coleman, *Economics and the Law: A Critical Review of the Foundations of the Economic Approach to Law*, 94 ETHICS 649, 678 (1984) (contrasting James Buchanan's constitutional economics with more traditional law and economics); Kelman, *Misunderstanding Social Life: A Critique of the Core Premises of "Law and Economics,"* 33 J. LEGAL EDUC. 274 (1983) ("I am by no means certain whether one can define, without considerable distortion, a 'core' to legal economics.").

9. *See* N. HERBERT, *supra* note 1; R. HUGHES, THE STRUCTURE AND INTERPRETATION OF QUANTUM MECHANICS 1 (1989); French, *Identity and Individuality in Classical and Quantum Physics*, 67 AUSTRALASIAN J. PHIL. 432, 445 (1989); Hellman, *Introduction to Special Issue on the Foundations of Quantum Mechanics*, 18 NOUS 557, 558 (1984).

10. *Cf.* French, *supra* note 9, at 446 ("[M]ore than one 'metaphysical package' may be consistent with a given physical theory.").

11. *See* M. JAMMER, *supra* note 7, at v; H. PAGELS, THE COSMIC CODE: QUANTUM PHYSICS AS THE LANGUAGE OF NATURE 25-27, 41, 66-67 (1982); J. POLKINGHORNE, THE QUANTUM WORLD 5 (1984).

the jurisprudential movements discussed.[12] Rather, the focus will be on how feminists, critical legal scholars, and legal economists each might constructively profit from the perspectives and insights of quantum theory. Third, this Article will not assume that the relationship between physical theory and legal theory must be hierarchical,[13] or that scientific theory is itself unaffected by social practice and social theory.[14] Finally, this Article does not assume that the lessons of quantum mechanics for legal theory will be dictatorial, or somehow logically inescapable. The most valuable lessons of quantum theory for legal theory are more a matter of suggestiveness, analogy, inspiration, and resonant metaphor than of strict deductive inference.[15] This is not at all to suggest that quantum theory is confined, at least directly, to the microscopic realm, or that quantum phenomena are not exhibited on the sort of scale with which human beings are most directly familiar. Quite the opposite is true.[16] Most of the lessons for the law from quantum mechanics are, however, merely offered rather than inescapably imposed.

This Article will proceed by briefly discussing some of the elements or interpretations of quantum mechanics that seem most richly suggestive for legal theory. In particular, the jurisprudential implications of what might be called "quantum-based universal relational holism" will be emphasized. Universal relational holism offers an attractive, natural synthesis of often apparently conflicting jurisprudential themes and methods. While some of the possible implications of these elements or interpretations of quantum mechanics for legal theory will be left implicit until the later portions of the Article, the reader with a particular interest in feminist legal studies, Critical Legal Studies, or law and economics is invited to begin inferring relationships between quantum mechanics and legal theory at any point. The drawing of such relationships in many cases will be controversial; such a task cannot in any event be completed within the bounds of this Article.

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12. *But cf.* Hughes, *Bell's Theorem, Ideology, and Structural Explanation*, in PHILOSOPHICAL CONSEQUENCES OF QUANTUM THEORY: REFLECTIONS ON BELL'S THEOREM 195, 196 (J. Cushing & E. McMullin eds. 1989) (raising the possibility of, but not developing, a feminist analysis of certain elements of quantum theory).

13. *See* Tribe, *supra* note 4, at 1-2.

14. *See* P. FEYERABEND, AGAINST METHOD 209 (1978) (arguing for a "democratic" approach to the truth of quantum theory).

15. *See* Tribe, *supra* note 4, at 2 (employing the language of metaphor and illumination in this context).

16. *See, e.g.*, P. FORREST, *supra* note 5, at 56-57; Clarke, *Quantum Theory and Cosmology*, 41 PHIL. SCI. 317 (1974); DeWitt, *Quantum Mechanics and Reality*, in THE MANY WORLDS INTERPRETATION OF QUANTUM MECHANICS 155 (B. DeWitt & N. Graham eds. 1973); Shimony, *The Reality of the Quantum World*, 258 SCI. AM. 46, 46 (Jan. 1988); Teller, *Quantum Mechanics and the Nature of Continuous Physical Quantities*, 76 J. PHIL. 345, 358 (1979).

II. INDETERMINACY AND THE HEISENBERG UNCERTAINTY PRINCIPLE

If there is any single element of quantum theory upon which legal writers have been least reluctant to seize, it is undoubtedly what has come to be known as the Heisenberg Uncertainty Principle.[17] Legal writers have taken the Heisenberg Uncertainty Principle to mean that, inevitably, the very act of measuring an object under scrutiny physically disturbs or alters that object.[18] This is thought to impose limits on the extent to which we can know objects "in themselves," or in their pristine state,[19] and to call into question the idea of a clear conceptual separation between the observer and the object being observed.[20] Beyond this, the Heisenberg Uncertainty Principle has been cited as authority for the subjectivity of at least some scientific judgments.[21]

This interpretation of the Heisenberg Uncertainty Principle offers, by way of analogy, some useful insights into legal practice and legal theory. Just as a Western anthropologist cannot helicopter down into an isolated village without in some measure altering that which was intended to be measured,[22] so a Supreme Court cannot, for example, measure the degree to which an asserted right is fundamental or basic to our political institutions[23] without, in the very act of measurement, to some degree affecting that which is to be measured.

This interpretation of the Heisenberg Uncertainty Principle, however, is not the only interpretation available. The principle itself is a matter of mathematical formulae.[24] While it is possible to interpret those formulae, as lawyers and some quantum theorists[25] do, in terms

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17. For a sampling of references to this principle by legal writers, see, *e.g.*, Bradley, *The Uncertainty Principle in the Supreme Court*, 1986 DUKE L.J. 1, 2 n.5; Christenson, *Uncertainty in Law and its Negation: Reflections*, 54 U. CIN. L. REV. 347, 351 (1985); Levit, *supra* note 1, at 295; Tribe, *supra* note 4, at 17-20; Williams, *Critical Legal Studies: The Death of Transcendence and the Rise of the New Langdells*, 62 N.Y.U. L. REV. 429, 441 (1987).

18. See each of the references cited *supra* note 17.

19. *See* Tribe, *supra* note 4, at 19.

20. *See id.*

21. *See* Christenson, *supra* note 17, at 351.

22. *See* Tribe, *supra* note 4, at 19.

23. *See, e.g.*, Duncan v. Louisiana, 391 U.S. 145, 148-49 (1968).

24. For brief discussions of the simple mathematical formulae involved, see 1 R. FEYNMAN, R. LEIGHTON & M. SANDS, THE FEYNMAN LECTURES ON PHYSICS 37-11 (1963); P. GIBBINS, PARTICLES AND PARADOXES: THE LIMITS OF QUANTUM LOGIC 59 (1987); K. POPPER, QUANTUM THEORY AND THE SCHISM IN PHYSICS 16 (1982); A. RAE, QUANTUM PHYSICS: ILLUSION OR REALITY? 10-11 (1986).

25. *See, e.g.*, 1 R. FEYNMAN, R. LEIGHTON & M. SANDS, *supra* note 24, at 38-8; W. HEISENBERG, THE PHYSICAL PRINCIPLES OF THE QUANTUM THEORY 3, 20 (C. Eckart & F. Hoyt trans. 1930). An early comment on the principle by Niels Bohr held that "the product of the mean errors with which two canonically conjugate mechanical quantities may be simultaneously measured can never be smaller than the quantum of action." N. BOHR, ATOMIC THEORY AND THE DESCRIPTION OF NATURE 95 (1961) (1929 formulation).

of the above "inevitable measurement disturbance" model, it is also possible to interpret the principle in another, perhaps more interesting way. The physicist Niels Bohr in particular rejected the measurement disturbance model in favor of what might be called an "inherent indeterminacy" model;[26] others have done the same.[27]

According to this more radical "inherent indeterminacy" interpretation of the Heisenberg Uncertainty Principle, a degree of indefiniteness or indeterminateness is associated with certain pairs of variables, such as a particle's position and momentum; mathematics or nature itself, rather than our physical disturbance of the system, underlies the uncertainties in the simultaneous measurement of those variables. On this more radical interpretation of the Heisenberg Uncertainty Principle, certain quantities are simply not well defined, as a matter of mathematics or nature.[28] Thus, the range of those uncertainties, multiplied together, is not, in one trial or over a series of trials,[29] reducible below a certain small quantity related to what is referred to as Planck's constant.[30] In plain terms, a particle does not have both a definite position and momentum with which our measurement awkwardly interferes.[31] The particle simply does not possess such definite attributes simultaneously, whether observed or not.[32]

This indeterminism is obviously difficult to visualize.[33] At the level of logic, rather than visualization, the reader may vaguely recall from

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26. It should be noted that Heisenberg himself endorsed this more radical interpretation. *See* W. HEISENBERG, PHILOSOPHICAL PROBLEMS OF QUANTUM PHYSICS 46 (F. Hayes trans. 1979) ("it is of the greatest importance that to speak simultaneously of a definite position and a definite impulse of a particle is meaningless."). For discussions of Bohr's approach, see P. GIBBINS, *supra* note 24, at 53; M. REDHEAD, INCOMPLETENESS, NONLOCALITY, AND REALISM: A PROLEGOMENON TO THE PHILOSOPHY OF QUANTUM MECHANICS 50 (1987); Hooker, *Energy and the Interpretation of Quantum Mechanics*, 49 AUSTRALASIAN J. PHIL. 262, 268-69 (1971).

27. *See, e.g.*, P. DAVIES & J. BROWN, THE GHOST IN THE ATOM 6-7 (1986); N. HERBERT, *supra* note 1, at 110; J. POLKINGHORNE, *supra* note 11, at 28; I. PRIGOGINE & I. STENGERS, *supra* note 4, at 224.

28. *See* I. PRIGOGINE & I. STENGERS, *supra* note 4, at 224.

29. For series-of-measurements interpretations, see H. PAGELS, *supra* note 11, at 88-90; W. HEISENBERG, *supra* note 25, at 20. For Bohr's individual particle interpretation, see P. GIBBINS, *supra* note 24, at 58-60.

30. For those keeping score, Planck's constant is 6.63 times 10 to the minus 34th power joule-seconds. J. POLKINGHORNE, *supra* note 11, at 6.

31. Note that we can sometimes measure a quantity without interacting with the object, as by recording that the object has *not* appeared at a particular place. *See* N. HERBERT, *supra* note 1, at 160.

32. *See* K. POPPER, *supra* note 24, at 17-18.

33. One hopeless way of trying to think about the Heisenberg Uncertainty Principle is to envision a gun shooting atomic-sized particles through holes of variable size at a target some further distance away. Our intuitions might suggest that as we diminish the size of the holes through which the emitted particle must pass, we increase the accuracy or concentration of results toward the center of the target. The Heisenberg Uncertainty Principle, however, dictates

high school mathematics that there is no commutative law for the multiplication of matrices, as opposed to ordinary integers.[34] Matrix A times Matrix B need not equal Matrix B times Matrix A. Ultimately, it is this lack of commutativity that most directly expresses the Heisenberg Uncertainty Principle,[35] because matrices turn out to be the natural way of expressing particle position and momentum.[36]

The "radical" interpretation of the principle, therefore, calls into question the validity of classical realism. Under this interpretation, certain states of affairs are simply "fuzzy" and indeterminate. If our photographs of such states of affairs look blurry, the explanation may lie not in our focusing, but in the inherent blurriness of the object being photographed. This interpretation is worth pursuing for its possible lessons for legal theory because, as we shall see below,[37] both Critical Legal Studies and, to a degree, feminist legal studies tend to call into question doctrines of realism, system determinacy, and objectivity in the law that seem analogous to those jeopardized particularly by the radical interpretation of the Heisenberg Uncertainty Principle.

III. Realism, Objectivity, and Wave-Particle Dualism

Thus far, we have referred to entities on the scale of electrons, photons, and so forth[38] as "particles," as though such entities were unequivocally like miniature pellets. Quantum mechanics, unfortunately, derails this comfortable assumption. Both the theory and the experimental evidence seem to require that we think of atomic-sized phenomena as resembling both particles and, incompatibly,[39] waves of some sort.

If, for example, we set up an apparatus shooting electrons one at a time through a barrier with two separate openings and at a target on the other side, we can, by varying the experimental conditions, ob-

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that at certain values, further reducing the size of the holes actually decreases the accuracy of the firing or the concentration of the pattern of hits at the target. *See* J. Bell, Speakable and Unspeakable in Quantum Mechanics 182-84 (1987).

34. *See* H. Campbell, An Introduction to Matrices, Vectors, and Linear Programming 12, 44 (1965); C. Miller & M. Lial, Fundamentals of College Algebra 314 (2d ed. 1986). For further relevant mathematics, see generally J. Ortega, Matrix Theory (1987).

35. *See* P. Gibbins, *supra* note 24, at 25-27; H. Pagels, *supra* note 11, at 76; I. Prigogine & I. Stengers, *supra* note 4, at 223.

36. *See* H. Pagels, *supra* note 11, at 75-76.

37. *See infra* notes 107-134 & accompanying text.

38. For our purposes, the behavior of all atomic and sub-atomic sized particles may be treated as equivalent. *See* 1 R. Feynman, R. Leighton & M. Sands, *supra* note 24, at 37-1.

39. Heisenberg observed that "it is obvious that a thing cannot be a form of wave motion and composed of particles at the same time—the two concepts are too different." W. Heisenberg, *supra* note 25, at 10.

serve either particle-like or wave-like behavior. If we set up electron detectors at both of the openings, we discover that each electron goes through one of the two openings, but not both, on the way to the target, where the electron's arrival may be recorded as a discrete, particle-like impact. If, however, we instead pay attention only to the pattern or distribution of electron arrivals, we discover wave-like behavior in the form of interference phenomena. The pattern of electron arrivals is different from the combination of patterns that would result from mechanically "adding up" the patterns resulting from firing at the target with one, and then the other, opening being closed. Remarkably, no electron can reach certain places at the target if the barrier has two openings; yet, some electrons do reach those places if either one, but not both, of the openings is available.[40]

It seems unavoidable that the mere availability of a second route to the target itself prevents the arrival of any electrons at particular locations on the target.[41] This curious result can be understood, at least superficially, by thinking of each electron as some sort of wave. On this approach, each electron, rather than being pellet-like, is thought of as dispersed or smeared out spatially,[42] so that a single electron can at certain points interfere with itself, in wave-like fashion, cancelling itself out and thereby preventing its appearance at certain locations on the target.[43]

If we insist on pressing ahead to ask of what electron waves consist, or whether they are "real," the answers quickly become varied and equivocal.[44] Our ordinary sense of the unshakeability of objectivity and realism is jeopardized by answers suggesting that such waves are merely "probability waves," or that such questions are unanswerable.[45] When we try to describe the world in this realm, at least insofar

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40. For brief accounts of wave-particle dualism, see, *e.g.*, J. BELL, *supra* note 33, at 182-87; 1 R. FEYNMAN, R. LEIGHTON & M. SANDS, *supra* note 24, at 37-2 to 37-9; P. GIBBINS, *supra* note 24, at 37-40; A. RAE, *supra* note 24, at 6-9.

41. *See* J. BELL, *supra* note 33, at 185.

42. For brief discussions of the phenomenon of a particle existing in geographically "spread-out" fashion, see, *e.g.*, Jones, *supra* note 6, at 327; Piron, *Quantum Mechanics: Fifty Years Later*, in SYMPOSIUM ON THE FOUNDATIONS OF MODERN PHYSICS 207, 210 (P. Lahti & P. Mittelstaedt eds. 1985).

43. *See* J. BELL, *supra* note 33, at 185.

44. *See infra* note 49 & accompanying text. Unfortunately, even the term "realism" itself is used in a variety of senses. *Compare, e.g.*, P. FORREST, *supra* note 5, at 4 *with* A. FINE, THE SHAKY GAME: EINSTEIN, REALISM AND THE QUANTUM THEORY 136-37 (1986).

45. *See* J. BELL, *supra* note 33, at 187; N. HERBERT, *supra* note 1, at 72. Even if we revert to thinking exclusively in particle terms, quantum mechanics, including in particular the Heisenberg Uncertainty Principle, will not allow us to assume that a particle must cross the distance between the gun and the target in a determinate, specifiable way. *See* Piron, *supra* note 42, at 210. Some theorists, however, say that the particle takes all possible paths simultaneously. N.

as we want a verbal, conceptual, or visual understanding, we seem to be left only with analogies of limited value.[46]

One alternative is to conclude that atoms are not objective or real, that we and the rest of the world are made up of atoms, that objectivity and realism generally are invalid, and ultimately, that traditional legal theory can by parallel reasoning be shown to be self-contradictory or subject to deconstruction in a literal sense. Consequently, legal reasoning should be exposed as a sham when it makes any pretenses to objectivity or realism.

Alternatively, we might choose not to dispense entirely with realism, but to conclude that reality can on occasion be, in an admittedly unvisualizable, inarticulable way, unavoidably dualistic. The world, and our legal system, may be describable in apparently mutually inconsistent ways. This general sort of unavoidable dualism, as physicists such as Niels Bohr have hoped,[47] may amount not to a dead end, but to a surprisingly fruitful perspective from which to consider longstanding problems of philosophy and society.[48] The strangeness of quantum mechanics need not commit us to anti-realism and the denial of the ideal of objectivity in science or in the law. It may simply be that the world is stranger than we thought.[49]

HERBERT, *supra* note 1, at 115-17; T. HEY & P. WALTERS, THE QUANTUM UNIVERSE 21-23 (1987). Alternatively, others say that the concept of path or trajectory cannot be used with precision, W. HEISENBERG, ENCOUNTERS WITH EINSTEIN 53-54 (1983), or that the idea of the path or trajectory of a particle is meaningless. P. GIBBINS, *supra* note 24, at 52.

46. *See* W. HEISENBERG, *supra* note 25, at 10.

47. *See* N. BOHR, *supra* note 25, at 100.

48. *See id.* (referring to an "unvisualizable" duality of free will and determinism); Jones, *Complementarity as a Way of Life*, *supra* note 6, at 320; Kothari, *The Complementarity Principle and Eastern Philosophy*, in NIELS BOHR: A CENTENARY VOLUME, *supra* note 6, at 325. *See also* Swinburne, *Could God Become Man?*, in PHILOSOPHY IN CHRISTIANITY 53, 53 (G. Vesey ed. 1989); Ward, *God as Creator*, in PHILOSOPHY IN CHRISTIANITY, supra, at 109, 117-18.

49. *See* Shimony, *Metaphysical Problems in the Foundations of Quantum Mechanics*, 18 INT'L PHIL. Q. 3, 3 (1978). For variant statements of forms of quantum realism, see, *e.g.*, D. BOHM, WHOLENESS AND THE IMPLICATE ORDER 67-69, 109 (1983); B. D'ESPAGNAT, REALITY AND THE PHYSICIST: KNOWLEDGE, DURATION, AND THE QUANTUM WORLD 147-49 (J. Whitehouse & B. D'Espagnat trans. 1989); P. FORREST, *supra* note 5, at 11-12 (adopting realism in at least an extended sense); H. KRIPS, THE METAPHYSICS OF QUANTUM THEORY 2-3, 31-32, 126-27 (1987) (endorsing a modified form of realism incorporating indeterminacy and probabilism); Bub, *Review Article: The Philosophy of Quantum Mechanics*, 40 BRIT. J. PHIL. SCI. 191, 206 (1989) (discussing Krips' realist account); K. POPPER, *supra* note 24, at xviii, 2, 175 (realism as compatible with indeterminacy and probabilism); Maxwell, *Quantum Propensiton Theory: A Testable Resolution of the Wave/Particle Dilemma*, 39 BRIT. J. PHIL. SCI. 1, 3 (1988) (realism as compatible with probabilism); Shimony, supra, at 13-14 (discussing realist approaches to overall quantum systems, as opposed to their constituent parts).

Anti-realist or non-realist positions and those positions denying objectivity are similarly formulated in a variety of ways. *See* P. DAVIES & J. BROWN, *supra* note 27, at 25 (under the "standard" or "Copenhagen" interpretation associated with Bohr and Heisenberg, "'atom' is simply

In choosing between anti-realism and dualism, we must bear in mind that, if we abandon realism and objectivity at the microscopic level, we must abandon them for macroscopic objects as well,[50] thereby abandoning, perhaps, an indispensable source of our motivation to explore and account for the world in the first place.[51] If the desire to understand how the world "really," "objectively" is has long motivated, and continues to motivate, the efforts of most scientists, as a pragmatic matter we should be reluctant to sap what might

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a convenient way of talking about what is nothing but a set of mathematical relations connecting different observations"); P. GIBBINS, *supra* note 24, at ix ("Quantum mechanics is most easily interpreted *antirealistically*, that is, as a theory which, though it works, does not describe the way the world is.") (emphasis in the original); Gibbins, *Quantum Logic and Ensembles*, in SPACE, TIME, AND CAUSALITY 191, 204 (R. Swinburne ed. 1983); W. HEISENBERG, *supra* note 26, at 16 (questioning the legitimacy of claims of objectivity); H. PAGELS, *supra* note 11, at 65 ("[t]he world just isn't 'there' independent of our observing it; what is 'there' depends in part on what we choose to see—reality is partially created by the observer"); Albert & Loewer, *Two No-Collapse Interpretations of Quantum Theory*, 23 NOUS 169, 174 (1989) ("[m]any of its adherents tend to think of quantum theory not as a description of natural processes but merely as a calculational device for predicting the outcomes of experiments"); Folse, *The Copenhagen Interpretation of Quantum Theory and Whitehead's Philosophy of Organism*, in 23 TULANE STUDIES IN PHILOSOPHY: STUDIES IN PROCESS PHILOSOPHY 32, 42-43 (R. Whittemore ed. 1974) (discussing Bohr on the inseparability of subject and object); Mermin, *Quantum Mysteries For Anyone*, 78 J. PHIL. 397, 397 (1981) ("[w]e now know that the moon is demonstrably not there when nobody looks"); Rohrlich, *Schroedinger's Criticism of Quantum Mechanics—Fifty Years Later*, in SYMPOSIUM ON THE FOUNDATIONS OF MODERN PHYSICS 555, 559 (P. Lahti & P. Mittelstaedt eds. 1985) (the "Copenhagen" interpretation as "phenomenalist" and "instrumentalist").

While anti-realist formulations such as Mermin's, *supra*, remind us of Bishop Berkeley's philosophical idealism, it is useful to recall that Bohr himself was unwilling to commit even to idealism. *See* Shimony, *supra*, at 12-13. For a sense of the congeniality of Berkeleyian idealism to certain other interpretations of quantum theory, see, *e.g.*, Folse, *supra*, at 37. Finally, for an appreciation of the dispute about how central the role of consciousness itself may be in constituting the quantum world, compare P. DAVIES & J. BROWN, *supra* note 27, at 31 (conscious observation, according to certain theorists, as triggering the collapse of a wave function's superposed possibilities into a particular "observed" concrete state of affairs) and A. RAE, *supra* note 24, at 63-64, 70 (same) with J. BELL, *supra* note 33, at 170 ("[t]he only 'observer' which is essential . . . is the inanimate apparatus which amplifies microscopic events to macroscopic consequences") and P. DAVIES & J. BROWN, *supra* note 27, at 32 (posing the question of what counts as a consciousness sufficient to collapse the equivocal superposed wave function into a single unequivocal reality) and A. RAE, *supra* note 24, at 68-71 (discussing the implausibility of large objects simultaneously existing and not existing, in a state of superposition, until conscious observation at some point somehow dictates that these possibilities be instantaneously reduced to one).

50. *See supra* note 16 & accompanying text. Some of the macroscopic consequences of quantum phenomena are popularly discussed under the rubric of the fate of Schroedinger's cat. *See, e.g.*, Rohrlich, *supra* note 49, at 563-64.

51. Albert Einstein recalled that in his youth, "there was this huge world, which exists independently of us human beings and which stands before us like a great, eternal riddle, at least partially accessible to our inspection and thinking." 1 A. EINSTEIN: PHILOSOPHER-SCIENTIST 5 (P. Schilpp 3d ed. 1982). John Polkinghorne has observed more generally that "I have never known anyone working in fundamental science who was not motivated by the desire to understand the way the world is." J. POLKINGHORNE, *supra* note 11, at 79.

turn out to be an indispensable, irreplaceable motivation by needlessly or prematurely adopting a highly controversial interpretation of the world that rejects any significant form of realism and objectivity.

IV. QUANTUM THEORY AND THE REALITY OF RELATIONAL HOLISM

Quantum theory and the experimentation it has inspired do not simply call traditional assumptions of realism and objectivity into question. Recent developments in quantum theory and actual experimentation have begun to offer an affirmative, constructive contribution to our historical quest to understand the natural and social world. A large and increasing number of scientists and quantum philosophers have begun to see the world as more deeply relational and holistic, and less a matter of discrete individuals, than most of us had imagined. It is simply a matter of time before the implications of quantum inseparability or quantum relational holism percolate through to reinforce, inspire, or modify jurisprudential movements such as feminist legal studies and legal economics. Feminists emphasizing relational thinking should be encouraged, while those legal economists who put great stock in the reality of discrete, if perhaps altruistic, individuals may be moved to reassess their position.

Even in the West, a sense of the importance of inseparability and of something like relational holism did not originate with modern physics. Writers as diverse as, for example, John Donne,[52] Walt Whitman,[53] Thomas Merton,[54] and Natan Sharansky[55] have expressed this intuition. The idea of inseparability has long been present to some degree even in orthodox, non-realist interpretations of quantum theory[56] as well as in ambitiously realist interpretations.[57]

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52. *See Devotions Upon Emergent Occasions: Meditation XVII*, in THE COMPLETE POETRY AND SELECTED PROSE OF JOHN DONNE 441 (C. Coffin ed. 1952) ("No man is an *Iland*, intire of it selfe; every man is a peece of the *Continent*, a part of the *maine* . . . . I am involved in *Mankinde*; And therefore never send to know for whom the *bell* tolls; It tolls for *thee*.") (italics in the original).

53. *See Song of Myself*, in COMPLETE POETRY AND SELECTED PROSE 25 (J. Miller ed. 1959) ("every atom belonging to me as good belongs to you.").

54. *See* T. MERTON, NO MAN IS AN ISLAND xxii (1955) ("[e]very other man is a piece of myself, for I am a part and a member of mankind.").

55. *See* N. SHARANSKY, FEAR NO EVIL 360 (S. Hoffman trans. 1988) (referring to an experience of "a mystical feeling of the interconnection of human souls").

56. *See, e.g.*, A. RAE, *supra* note 24, at 51 (discussing Bohr's view that the two particles in a two-particle quantum system cannot be considered separate until a measurement is made to separate them).

57. *See* D. BOHM, *supra* note 49, at 134. On Bohm's approach, quantum theory requires "the dropping of the notion of analysis of the world into relatively autonomous parts, separately existent but in interaction. Rather, the primary emphasis is now on *undivided wholeness*, in

What might be called the "new" relational holism, however, has received its major impetus from the theoretical and experimental response to the theoretical work of the physicist John Stewart Bell, who was motivated by a challenge posed by what is known as the Einstein-Podolsky-Rosen thought experiment.[58] Einstein and his colleagues had sought to question the completeness of quantum theory by means of a thought experiment that relied on certain apparently uncontroversial premises, including that of separability or local causality, which precludes instantaneous effects across distances.[59]

In a simplified version of the thought experiment propounded by Einstein and his colleagues, two particles prepared in what is referred to as the "singlet spin state"[60] are beamed from a common source in opposite directions, so that they become apparently widely separated in space. As each of the particles approaches a stationary but adjustable magnet and a detecting screen, it is deflected either up or down by the magnet, and the results are recorded at the detecting screen.[61] The experimental conditions are specified so that it seems inescapable that the result of a measurement of either particle can depend only on the state of that separate particle, including the lingering effects of its prior interaction with the other particle and other "local" conditions in the vicinity of the site of each measurement.[62]

If that is so, the measurements of the spin of each particle along various axes should be statistically independent of simultaneous measurements or the results of measurements on the now distant other particle. The joint probability of spin measurements along various

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which the observing instrument is not separable from what is observed." *Id.* (emphasis in original). *See also* Bohm, *Bohr's Views Concerning the Quantum Theory*, in NIELS BOHR: A CENTENARY VOLUME 156, 157-58 (A. French & P. Kennedy eds. 1985); Selleri, *Introduction*, in QUANTUM MECHANICS VERSUS LOCAL REALISM: THE EINSTEIN-PODOLSKY-ROSEN PARADOX 47-49 (F. Selleri ed. 1988) (Discussing Bohm's view that "[i]n space there is only an 'unbroken wholeness,' which sometimes can give rise to manifestations which *appear* as two separate objects.") (emphasis in the original).

58. For a discussion of the historical background of the Einstein-Podolsky-Rosen thought experiment, see Jammer, *The EPR Problem in its Historical Development*, in SYMPOSIUM ON THE FOUNDATIONS OF MODERN PHYSICS 129 (P. Lahti & P. Mittelstaedt eds. 1985).

59. *See* J. BELL, *supra* note 33, at 143.

60. The singlet spin state implies that along a particular axis, the "spin" of the two particles will mathematically cancel each other, yielding a net or total spin of zero. *See* J. POLKINGHORNE, *supra* note 11, at 70.

61. *Cf.* J. BELL, *supra* note 33, at 139-40. Bell discusses his theoretical response to this experimental setup in the user-friendly language of the idiosyncratic choice of unmatching socks by a Dr. Bertlmann. *See id.* at 139-58.

62. *See* Howard, *Holism, Separability, and the Metaphysical Implications of the Bell Experiments*, in PHILOSOPHICAL CONSEQUENCES OF QUANTUM THEORY: REFLECTIONS ON BELL'S THEOREM 224, 228 (J. Cushing & E. McMullin eds. 1989). The "local" conditions can include any persisting effects of the prior interaction between the two particles. *See id.* at 229 n.8.

axes for both particles should reflect simply the separate probabilities of the two measurements multiplied together.[63] Bell theorized, however, that if quantum theory were correct, the results of simultaneously measuring the spins along different axes of the apparently separated particles should show a stronger correlation than could be explained by any theory that assumed only "local reality," including the lingering effects of the prior interaction of the particles.[64] A remarkable degree of apparent "cooperation" between the two particles has in fact been observed in experiments conducted over a period of years.[65]

The derivation of the mathematical formulae tested in such experiments is beyond the scope of this paper.[66] It is the interpretation of the experimental results that is of greater immediate interest. A range of possible interpretations of the experimental results has arisen,[67] and no

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63. *See id.* at 228; Jarrett, *On the Physical Significance of the Locality Conditions in the Bell Arguments*, 18 NOUS 569, 573 (1984).

64. *See* B. D'ESPAGNAT, *supra* note 49, at 14-15. John Polkinghorne expressed the oddness of what happens in this context by observing that the act of measuring a spin component for the first particle must constitute or alter the second particle—rather than merely reveal or disclose some preexisting fact—because measuring different spin components of the first particle seems to produce "different and indeed contradictory" results for the now distant second particle. *See* J. POLKINGHORNE, *supra* note 11, at 70-71. Measuring the first particle's spin along the x-axis "forces" the second particle's spin along the same axis to be the opposite. Thus, if the first particle's spin along the x-axis is measured as "up," the second particle's spin along the x-axis must definitely be measured to be "down." But if we choose instead to measure the first particle's spin along the z-axis, that measurement seems to force the second particle, inconsistently, into an indefinite state of spin along the x-axis: an equal superposition of the states of spin "up" and spin "down" along the x-axis. *See id.* Thus, depending on what we measure about the first particle, the second particle's spin along the x-axis is either definite (let us say, "up") or indefinite (both up and down). This result is, to put it mildly, a curious one.

65. *See* M. REDHEAD, *supra* note 26, at 107-13 (discussing laboratory tests of the Bell Inequalities); Howard, *supra* note 62, at 229.

66. For a series of informal discussions of the derivation of the Bell Inequalities, *see* Mermin, *supra* note 49; Mermin, *A Bolt From the Blue*, in NIELS BOHR: A CENTENARY VOLUME 143-45 (A. French & P. Kennedy eds. 1985); Mermin, *Can You Help Your Team Tonight By Watching On TV? More Experimental Metaphysics From Einstein, Podolsky, and Rosen*, in PHILOSOPHICAL CONSEQUENCES OF QUANTUM THEORY: REFLECTIONS ON BELL'S THEOREM 38 (J. Cushing & E. McMullin eds. 1989). For a slightly more elaborate but still informal discussion, *see* d'Espagnat, *The Quantum Theory and Reality*, 241 SCI. AM. 158 (Nov. 1979).

67. Among the exotic interpretations presented have been the possibility of retroactive or "backward" causation, with future choices influencing the past, and of probabilities outside their usual numerical bounds, including "negative" probabilities of the occurrence of an event. *See* Selleri, *Preface*, in QUANTUM MECHANICS VERSUS LOCAL REALISM viii (F. Selleri ed. 1988). The idea of sharp or well-defined quantum properties can also be questioned. *See, e.g.*, Barreau, *Reality in Classical Physics and Reality in Quantum Theory*, in SYMPOSIUM ON THE FOUNDATIONS OF MODERN PHYSICS 73, 79 (P. Lahti & P. Mittelstaedt eds. 1985) (suggesting that sharp properties and locality or separability are difficult to test separately). Bernard d'Espagnat has pointed out that we can account for the observed results not only by denying separability or locality, or by adopting a less "realist" view of the world, but also by modifying our assumption of the

single interpretation yet commands unanimous assent. Perhaps the most intuitively plausible, apparently straightforward, and popular interpretation, however, suggests that it is wrong to think of the two particles, even though apparently separated by vast distances, as genuinely separate and discrete.

The terminology employed in such interpretations varies. Concepts such as objective entanglement,[68] nonlocality,[69] and nonseparability[70] are used, sometimes in different senses,[71] and sometimes in mutually distinguishable ways.[72] The commonly used term that is perhaps most resonant for the non-physicist is that of "holism."[73] The net result seems to be "that tough-minded physicists have become the advocates of a doctrine which historically was defended by tender-minded and romantic writers."[74]

While it is difficult to be precise at this point about just what sort of holism the world seems to be presenting to us, it does seem apparent that quantum-based holism is not simply a matter of the whole being other than the sum of the parts, or that the states of the parts do not exhaust or specify the state of the whole. Rather, the state of the overall system cannot be reduced to the states of its component parts, because the parts are simply not in definite states in and of

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general validity of inductive inference. *See* d'Espagnat, *supra* note 66, at 158, 160. One could simply find the experimental tests of the Bell Inequalities to produce mysterious correlations, while denying the need for further explanation. *See* van Fraassen, *EPR: When Is a Correlation Not a Mystery?*, in SYMPOSIUM ON THE FOUNDATIONS OF MODERN PHYSICS, *supra*, at 113, 113.

68. Shimony, *Search For a Worldview Which Can Accommodate Our Knowledge of Microphysics*, in PHILOSOPHICAL CONSEQUENCES OF QUANTUM THEORY: REFLECTIONS ON BELL'S THEOREM 25, 27 (J. Cushing & E. McMullin eds. 1989); Shimony, *Contextual Hidden Variables Theories and Bell's Inequalities*, 35 BRIT. J. PHIL. SCI. 25, 35 (1984); Shimony, *supra* note 16, at 46.

69. *See* B. D'ESPAGNAT, *supra* note 49, at 15; Stapp, *EPR: What Has It Taught Us?*, in SYMPOSIUM ON THE FOUNDATIONS OF MODERN PHYSICS 637, 638 (P. Lahti & P. Mittelstaedt eds. 1985); Weizsacker, *Quantum Theory and Space-Time*, in SYMPOSIUM ON THE FOUNDATIONS OF MODERN PHYSICS, *supra*, at 223; Howard, *supra* note 62, at 225; Nordin, *Determination and Locality in Quantum Mechanics*, 42 SYNTHESE 71, 71, 89 (1979).

70. *See* Howard, *supra* note 62, at 225; Jarrett, *Bell's Theorem: A Guide to the Implications*, in PHILOSOPHICAL CONSEQUENCES OF QUANTUM THEORY 60, 79 (J. Cushing & E. McMullin eds. 1989) (the apparently separated particles as somehow "connected" so as to "form a single object"); Shimony, *supra* note 49, at 5.

71. *See* M. REDHEAD, *supra* note 26, at 116-17 (distinguishing five different senses of the concept of locality).

72. *See* Bub, *supra* note 49, at 209 (distinguishing nonseparability from any sort of instantaneous action at a distance between particles); Howard, *supra* note 62, at 225-28 (distinguishing nonseparability as the "source" of nonlocality).

73. *See* Howard, *supra* note 62, at 225, 227 ("a radical physical holism"); Shimony, *supra* note 49, at 5. *See also* Rohrlich, *supra* note 49, at 569-70 (the measurement apparatus as interacting with the whole system, not merely with one of the two particles).

74. Shimony, *supra* note 49, at 5.

themselves.[75] Quantum holism is no less mysterious than any other aspect of quantum theory.

Even if we recognize, as we apparently must, that quantum holism applies not merely to microscopic entities such as atoms, but to medium-sized objects, such as human beings,[76] our traditional Western version of common sense insists that we can think of individual persons precisely as discrete individuals. Like a stage magician, we can pass a gleaming metal hoop around an individual person, thereby firmly establishing that no detectable delicate strands link individuals. Unless we begin to think in Whitmanesque terms,[77] we will continue to insist, for all purposes, on the reality of discrete individual persons.

Perhaps the best way to accommodate this sense of individualism with the experimentally revealed facts of the world is to think, as the philosopher Paul Teller suggests, in terms of "relational holism."[78] According to relational holism, "objects which in at least some circumstances we can identify as separate individuals have *inherent relations*, that is, relations which do not supervene on the non-relational properties of the distinct individuals."[79] We do not, as it were, start with non-social human beings who then contingently choose to, or somehow wind up, changing their identities by entering into social relationships—altruistic, manipulative, sacrificial, or exploitive. Rather, the identity of the human being is constituted as primarily or fundamentally by social relationships as by any other aspect of that person. Identity is, in part, identity-sharing. What some mystics and sociologists have long argued for turns out to be suggestively reinforced, if not confirmed, by physics.

One further implication should be drawn out. Relational holism cannot be narrowly confined. Relational holism is nearly universal, with respect not only to what or who is part of the whole, but also to what or with whom we are related. An apt metaphor or analogy will

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75. *See id.*

76. *See* Teller, *Quantum Physics, The Identity of Indiscernibles, and Some Unanswered Questions*, 50 PHIL. SCI. 309, 318 (1983).

77. *See supra* note 53 and accompanying text. Professor Henry Stapp has observed that with the rise of relational holism within physics, a human "appears no longer as an isolated automaton. . . . This revision of the conception of a person . . . cannot help but have an immense impact on what is perceived as valuable. It must inevitably lead us away from the egocentric bias that was the rational product of the ontology of classical physics . . . ." Stapp, *Quantum Theory and the Physicist's Conception of Nature: Philosophical Implications of Bell's Theorem*, in THE WORLD VIEW OF CONTEMPORARY PHYSICS: DOES IT NEED A NEW METAPHYSICS? 38, 57 (R. Kitchener ed. 1988).

78. Teller, *Relational Holism and Quantum Mechanics*, 37 BRIT. J. PHIL. SCI. 71, 73 (1986).

79. *Id.* (emphasis in original).

not allow us to think of ourselves as inherently related merely to, say, our favorite social or cultural group or category, while thinking of others in exclusionary terms. The physicist Bernard d'Espagnat has observed that:

> Most particles or aggregates of particles that are ordinarily regarded as separate objects have interacted at some time in the past with other objects. The violation of separability seems to imply that in some sense all these objects constitute an indivisible whole. Perhaps in such a world the concept of an independently existing reality can retain some meaning, but it will be an altered meaning and one remote from everyday experience.[80] Thus, a universality of relatedness is both inescapable and permanent.[81]

Tracing out the jurisprudential implications or the eventual influence, directly or metaphorically, of universal relational holism is a task for the long term. As an initial guess, one might hazard that universal relational holism will encourage those elements in feminist jurisprudence that, while perhaps suspicious of some claims involving the concept of universality, strongly emphasize the primacy of relations and relationalism in jurisprudential thinking.[82] Universal relational holism, on the other hand, would not appear to harmonize particularly well with the strong individualism, whether altruistic or selfish, often thought to underlie approaches to law and economics that purport to describe the world, as opposed to merely instrumental-

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80. D'Espagnat, *supra* note 66, at 181.

81. On this point, Nick Herbert has written that:

> Since there is nothing that is not ultimately a quantum system, if the quantum phase connection is "real," then it links *all systems that have once interacted at some time in the past*. . . into a single waveform whose remotest parts are joined in a manner unmediated, unmitigated, and immediate. The mechanism for this instant connectedness is . . . that a bit of each part's "being" is lodged in the other. Each [quantum entity] leaves some of its "phase" in the other's care, and this phase exchange connects them forever after.

N. HERBERT, *supra* note 1, at 223 (emphasis in original). *See also* Teller, *supra* note 78, at 80-81 ("[T]he world is a more deeply intermeshed web than we thought. Indeed, according to quantum mechanics, the extent of entanglement through inherent relations is all pervasive. Each and every scattering interaction gives rise to inherent relations, so that every non-isolated object gets caught up with other objects in the web of the inherently relational."); Howard, *supra* note 62, at 248.

82. For references to the primacy of relations, see, e.g., Held, *Feminism and Epistemology*, 14 PHIL. & PUB. AFF. 296, 299-302 (1985); Menkel-Meadow, *Portia in a Different Voice: Speculations on a Women's Lawyering Process*, 1 BERKELEY WOMEN'S L.J. 39, 40-43 (1985); Minow, *supra* note 8, at 133; Scales, *supra* note 6, at 1383; Sunstein, *Introduction: Notes on Feminist Political Thought*, 99 ETHICS 219, 219 (1989).

ist versions of law and economics.[83] Neither does the idea of a universal inherent relatedness or inseparability of persons appear initially to support at least the most thoroughly nihilist factions within the broader Critical Legal Studies movement.[84] These themes are traced further in the concluding section below.

V. THE MANY-WORLDS VIEW AND THE EVACUATION OF LEGAL RESPONSIBILITY

One final approach, or family of approaches,[85] to the interpretation of quantum phenomena deserves mention because of its growing popularity, unique status, and distinctive jurisprudential implications. The many-worlds view combines spectacular initial implausibility and some ultimately unattractive moral and jurisprudential implications with what is in some ways the simplest and most straightforward approach to several daunting theoretical problems.

The many-worlds view or, in some variations, the "many minds" view,[86] offers at least the beginnings of an account of what happens when, say, a quantum entity existing equivocally in a "superposition" of states is somehow always observed to be existing solely in one, but not both, of those two states. In a well-known example, a quantum-entangled cat exists in a simultaneous combination or superposition of

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83. Perhaps the most useful discussion in this regard is Sen, *Rational Fools: A Critique of the Behavioral Foundations of Economic Theory*, 6 PHIL. & PUB. AFF. 317 (1977). For other recent discussions of some of the relevant presuppositions of legal economic analysis, see Harrison, *Egoism, Altruism, and Market Illusions: The Limits of Law and Economics*, 33 UCLA L. REV. 1309, 1309-13 (1986); Kelman, *Misunderstanding Social Life: A Critique of the Core Premises of "Law and Economics,"* 33 J. LEGAL EDUC. 274, 275 (1983) (characterizing orthodox law and economics as assuming that "[h]uman behavior is adequately described as utility-maximizing behavior of selfish, privatized individuals."); Kolm, *Altruism and Efficiency*, 94 ETHICS 18, 18 (1983). For a sense of how a less purely "instrumentalist" legal economics might begin to adapt to universal relational holism, see the merely contingent "entanglement" or inseparability of utility functions referred to in Friedman, *Does Altruism Produce Efficient Outcomes? Marshall Versus Kaldor*, 17 J. LEGAL STUD. 1, 2-3 (1988). For a discussion of the idea of the separateness of persons in utilitarian theory, see D. BRINK, MORAL REALISM AND THE FOUNDATIONS OF ETHICS 283-89 (1989). *Cf.* Harman, *Is There A Single True Morality?*, in RELATIVISM: INTERPRETATION AND CONFRONTATION 363, 376 (M. Krausz ed. 1989) ("someone can be completely rational without feeling concern and respect for outsiders.").

84. For a discussion of what might be characterized as the nihilist or irrationalist wing of Critical Legal Studies, see generally Stick, *Can Nihilism Be Pragmatic?*, 100 HARV. L. REV. 332 (1986).

85. *See* Healey, *How Many Worlds?*, 18 NOUS 591, 591 (1984). For Professor Healey's own interpretation of quantum mechanics, see Healey, *Quantum Realism: Naïveté Is No Excuse*, 42 SYNTHESE 121 (1979) and, more comprehensively, R. HEALEY, THE PHILOSOPHY OF QUANTUM MECHANICS: AN INTERACTIVE INTERPRETATION (1989).

86. *See* Albert & Loewer, *supra* note 7, at 207 ("an infinity of minds associated with each sentient being."); Albert & Loewer, *supra* note 49, at 179, 181.

the states of being completely alive and being completely deceased. Quantum theory has offered no widely satisfactory account of the apparent "collapse of the wave function" in which the superposed live and deceased cats somehow snap into a determinate state of unequivocal life, or of unequivocal death, before, during, after, or because of our observation.

The many-worlds approach avoids the necessity of explaining a collapse of the wave function, or of how one of the ghostly possibilities—the live, or the deceased, cat—is mysteriously promoted to observed reality. All of the quantum possibilities are realized on the many-worlds view, and each is equally real.[87] This simplicity is purchased, however, at the price of prodigality in another respect. In an unobserved way, the "universe is constantly splitting into a stupendous number of branches, all resulting from the measurementlike interactions between its myriads of components. Moreover, every quantum transition taking place on every star . . . is splitting our local world on earth into myriads of copies of itself."[88] It has been suggested that, according to such a view, roughly ten to the hundredth power divergent "copies" or presentations of each identifiable "self" may exist,[89] and that the total number of worlds now in existence may amount to something like ten to the tenth power, to the twelfth power.[90]

The natural inclination at this point is to assume that we should invoke Ockham's Razor[91] against the many-worlds approach, and be done with it. Unfortunately, it is unclear whether the many-worlds view unequivocally violates Ockham's Razor, at least in any sense fatal to that view.[92] While the many-worlds view multiplies entities—indeed, universes—prodigiously, it may not do so needlessly, or without any compensating gain in the simplicity or power of the interpretation. Ultimately, it is not easy to say unequivocally whether the

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87. *See* Everett, *The Theory of the Universal Wave Function*, in THE MANY-WORLDS INTERPRETATION OF QUANTUM MECHANICS 116-17 (B. DeWitt & N. Graham eds. 1973).

88. DeWitt, *supra* note 16, at 155, 161. *See also* Stein, *The Everett Interpretation of Quantum Mechanics: Many Worlds or None?*, 18 NOUS 635, 647 (1984).

89. *See* DeWitt, *supra* note 88, at 161.

90. *See* A. RAE, *supra* note 24, at 79.

91. For diverse statements of this principle, see 1 M. ADAMS, WILLIAM OCKHAM 156-60 (1987).

92. For an ultimately inconclusive debate as to the parsimoniousness of the many-worlds view, see Clarke, *supra* note 16, at 319; Geroch, *The Everett Interpretation*, 18 NOUS 617, 626 (1984); Healey, *How Many Worlds?*, 18 NOUS 591, 599 (1984); Leslie, *Observership in Cosmology: The Anthropic Principle*, 92 MIND 573, 579 (1983); Skyrms, *Possible Worlds, Physics and Metaphysics*, 30 PHIL. STUD. 323, 328 (1976).

many-worlds view is parsimonious or not.[93] By denying the need for the collapse of the wave function by some entity or observer "outside" the quantum system, the many-worlds view can hold open the possibility of a wave function, and a quantum description, for the entire universe,[94] which makes the many-worlds view attractive to cosmologists,[95] even if its appeal is still far from unanimous.[96]

At this point, it is important for jurisprudential purposes to note the rather dramatic effects of the many-worlds view on our common conceptions of legal responsibility and the moral logic underlying the policies of the criminal and civil law. We find many incomplete versions of the many-worlds view and many contrasting understandings of responsibility and morality. The general nature of some of the problems, though, seems clear.

Recall that the many-worlds view, on leading versions, involves every quantum transition instantaneously splitting every object and every person in the universe into multiple "copies."[97] Consider also that "every choice we have made in our lives may be associated with a quantum event in our brains."[98] Upon reflection, the jurisprudential problems begin to multiply nearly as fast as the alternate worlds. As one popular defender of an exotic version of the many-worlds view has suggested, "If every time I choose, all of my parallel *mes* are also choosing, then is there really any choice? If any choice means all of them, then perhaps choice is just another illusion."[99]

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93. *Cf.* M. ADAMS, *supra* note 91, at 160 (noting the difficulty in articulating the meaning and importance of theoretical simplicity).

94. *See* Albert & Loewer, *supra* note 7, at 197.

95. *See id*; *see generally* J. LESLIE, UNIVERSES (1989).

96. For representative criticisms, or questions regarding, the many-worlds view, see, *e.g.*, J. POLKINGHORNE, SCIENCE AND CREATION: THE SEARCH FOR UNDERSTANDING 24 (1989) (the many-worlds view dismissed as too prodigal and contrived); I. PRIGOGINE & I. STENGERS, *supra* note 4, at 228 (many-worlds view as "improbable"); A. RAE, *supra* note 24, at 81-83 (many-worlds view as unclear on when splitting occurs or a measurement-like interaction occurs); Carr, *On the Origin, Evolution and Purpose of the Physical Universe*, in PHYSICAL COSMOLOGY AND PHILOSOPHY 134, 152-53 (J. Leslie ed. 1990) (many-worlds view, involving observation-based world-splitting, as "rather bizarre" and not recommended to be taken seriously); Swinburne, *Argument From the Fine-Tuning of the Universe*, in PHYSICAL COSMOLOGY AND PHILOSOPHY, *supra*, at 154, 170-71 (many-worlds interpretation as not reasonably justifiable); Albert & Loewer, *supra* note 7, at 201 (many-worlds view as involving unobservable violation of basic conservation laws across the universe as a whole); Albert & Loewer, *supra* note 49, at 181 (same); Clarke, *supra* note 16, at 331 (many-worlds view unclear on when world-splitting occurs); Healey, *supra* note 92, at 592-614 (discussing several interpretive problems); Linde, *Inflation and Quantum Cosmology*, in THREE HUNDRED YEARS OF GRAVITATION 627 (S. Hawking & W. Israel eds. 1987) (citing several interpretive problems); Stein, *supra* note 88, at 651 (many-worlds view as not solving the problem of observation in quantum theory).

97. *See supra* note 88 and accompanying text; *see also* J. BELL, *supra* note 33, at 135.

98. A. RAE, *supra* note 24, at 80.

99. F. WOLF, PARALLEL UNIVERSES: THE SEARCH FOR OTHER WORLDS 98 (1988) (emphasis in the original).

If every quantum transition involves the realization of all of the quantum possibilities, then every airplane crash due, say, to metal fatigue also involves one or more successful parallel flights,[100] all of which are equally real. The consequences, however, do not stop with the comforting thought that even if we crash, multiple twins of ourselves survive. The many-worlds view does not simply encourage what would ordinarily be thought of as risk-taking behavior; the view jeopardizes much of our understanding of responsibility and good conduct.

Consider, for example, a "many-worlds defense" at a quantum murder trial. The defendant can argue that even if he, and not some "copy," can be legitimately haled into court, his action did not result simply in what we ordinarily think of as a murder. While there may have been an intentional taking of another's life, the multiplication or "production" of that same "victim's" life was inherent in the same action for which the defendant is being tried. It is not as though the defendant simply killed the victim; other versions of the victim survive, as "insurance," in worlds not observable to us. Quantum killing, rather, necessarily involves the multiplication of persons.

Undeniably, the grief of, say, the victim's surviving spouse, in any world in which there was a murder victim, is quite real. That suffering must not be ignored. But we will need to develop some explanation of why the quantum murderer cannot point, at least in mitigation, to his "production" of worlds in which the "victim" in this world goes on, in those newly created worlds, with the "victim's" spouse, to lead joyous, fulfilled lives. Those additional worlds, and that joy, are as real as anyone's suffering. It may well be that a "well-designed" quantum murder could increase not only the total amount of happiness, or the total net excess of happiness over unhappiness, over all worlds, but could increase the average amount of happiness, or average excess of happiness over unhappiness, even on a per world basis.[101]

We will need, more generally, some account of why a person's deliberately producing diverse new "worlds" should be considered a morally trivial act. If we assume, for whatever reason, that we are in a good world, or an above average world, why aren't we morally well-advised to spend most of our spare time running particles through multi-slit apparatuses, thereby running off copies of good, or above

100. The airplane crash scenario is briefly mentioned in J. POLKINGHORNE, *supra* note 11, at 68.

101. Consider, for example, a quantum murder weapon designed for many "no-death" results for every "death" result.

average average, worlds?[102] If we assume the opposite, why isn't one of our highest moral duties something we might call "quantum quiescence?" The fact, if it is such, that the same sort of world-splitting is resulting all the time anyway from "natural" quantum transitions throughout our world[103] does not show the incoherence of this understanding of our moral duty; it merely shows that, independently of our will, the effects of our intentional efforts along these lines to create good states of affairs, and not create bad ones, will be swamped by what happens in nature.

This is not to conclude that our familiar conceptions of legal responsibility, exculpation, defense, and mitigation cannot possibly be preserved if the many-worlds quantum view turns out to be right. But given the jeopardy in which the many-worlds view places our sense of legal responsibility, we may be led to ask anew whether it really offers significant advantages.[104]

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102. We would thereby bring goodness into being just as surely and intentionally as if we had exercised an ordinary moral virtue, such as being kind, in a single world. We would perhaps even raise the average level of goodness of all worlds combined.

103. *See supra* note 88 and accompanying text.

104. For some persons, one of the attractions of the many- worlds view is its ability to minimize the dramatic implications of what has been called the "anthropic coincidences." The idea of anthropic coincidences refers to the apparent "fine tuning" or precise, knife-edge-balanced tolerances involved—in independent and sometimes "overdetermined" fashion—in many of the universe's basic physical constants and the relationships among basic particles and forces. Had any of these balances, values, or relationships differed by a relatively small amount, no recognizable sort of life would have been able to develop. That life exists anywhere at all in the universe is, in view of the mathematics of probability, stunning. For discussions of the anthropic coincidences, see R. ADAIR, THE GREAT DESIGN: PARTICLES, FIELDS, AND TIME 366 (1987); J. BARROW, THE WORLD WITHIN THE WORLD 352-65 (1988); J. BARROW & F. TIPLER, THE ANTHROPIC COSMOLOGICAL PRINCIPLE (1986); S. HAWKING, A BRIEF HISTORY OF TIME: FROM THE BIG BANG TO BLACK HOLES 125 (1988); J. LESLIE, *supra* note 95, at 25-56; B. LOVELL, EMERGING COSMOLOGY 196-97 (1981); H. MONTEFIORE, THE PROBABILITY OF GOD (1985); J. POLKINGHORNE, *supra* note 96, at 22-23; Swinburne, *supra* note 96, at 154-72. The many-worlds view is enlisted at this point as one of the more plausible means available to attempt to blunt the force or interest of the anthropic coincidences. *See* J. LESLIE, *supra* note 95, at 66-103; B. LOVELL, *supra*, at 197; Smith, *The Anthropic Principle and Many-Worlds Cosmologies*, 63 AUSTRALASIAN J. PHIL. 336 (1985). If there are a huge number of diverse "worlds," including our entire observable universe as only one of this huge number, it becomes much less surprising that intelligent observers are around to survey at least one world permitting intelligent life.

Proceeding on the assumption that quantum theory can be applied to the entire universe, some writers have sought to apply quantum theory to begin the task of supplying an explanation for the existence of the universe itself. On such a theory, the universe would have spontaneously bubbled up into being as an unusually significant, long-lived random "vacuum fluctuation," violating no conservation laws in the process. *See* J. BARROW, *supra*, at 231; T. HEY & P. WALTERS, *supra* note 45, at 294; Thomsen, *The Quantum Universe: A Zero-Point Fluctuation?*, 128 SCI. NEWS 72 (Aug. 3, 1985). For the view that the universe itself may be the ultimate free lunch, or quasi-free lunch, see Blau & Guth, *Inflationary Cosmology*, in THREE HUNDRED YEARS OF GRAVITATION 595 (S. Hawking & W. Israel eds. 1987); Grunbaum, *The Pseudo-Problem of Creation in Physical Cosmology*, 56 PHIL. SCI. 373 (1989); Guth & Steinhardt, *The Inflationary*

VI. CONCLUSION: INDETERMINACY, OBJECTIVITY, AND UNIVERSALITY IN LEGAL THEORY

Legal theorists of one perspective or another have occasionally been willing to make the philosophically dramatic claim that quantum mechanics demonstrates "that nature is on our side . . . ."[105] We have seen enough variety in the interpretation of quantum phenomena to suspect that any such claim must be qualified, but it seems equally clear that certain themes in quantum interpretation are at least somehow congenial to parallel themes developed in legal theory. Sometimes, the support in quantum theory for particular legal theories will be superficial and equivocal,[106] but the concord between quantum theory and legal theory may on other occasions be striking.

One obvious focus of interest is the concept of indeterminacy. The discussion above has offered at least some sense of the importance of irreducible indeterminacy in some mainstream interpretations of quantum mechanics.[107] The idea of irreducible indeterminacy also looms large in much contemporary legal theory.[108] Currently, indeterminacy theses are most obviously associated with the Critical Legal Studies movement.[109] Allan Hutchinson, for example, observes that

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Universe, 250 SCI. AM. 116, 116 (May 1984); Weiskopf, *The Origin of the Universe*, 36 N.Y. REV. BOOKS 10 (Feb. 16, 1989). For the convincing rebuttal that even a quantum "vacuum" is more like a seething, roiling ocean of temporarily existing particles and antiparticles than like anything that could qualify as presuppositionless or not calling for explanation, see J. BARROW, *supra*, at 231; J. LESLIE, *supra* note 95, at 80; M. MUNITZ, COSMIC UNDERSTANDING: PHILOSOPHY AND SCIENCE OF THE UNIVERSE 131-37 (1986); J. POLKINGHORNE, *supra* note 96, at 59-60; Craig, *God, Creation and Mr. Davies*, 37 BRIT. J. PHIL. SCI. 163, 166-69 (1986). Ultimately, there is something calling for explanation, by analogy, about a simultaneous "overdraft" and "deposit" into one's checking account, even if the amounts exactly cancel each other. It is fair to conclude that no plausible version of quantum theory avoids leaving interesting unanswered questions in attempting to explain or account for the universe.

105. Scales, *supra* note 6, at 1401.

106. For example, Professor Ronald Dworkin's "chain-novel" metaphor for the historical process of common law adjudication superficially parallels, in some respects, the physicist John Wheeler's metaphor of a game of Twenty Questions, with no predetermined answer, to suggest how all of natural history is constructed, or brought out of superposition, in a remarkably retroactive way, by human observation itself. *Compare* Dworkin, *Natural Law Revisited*, 34 U. FLA. L. REV. 165, 166-68 (1982) (allowing some tolerance of inconsistency in the joint or serial product of the creators for the sake of a "better story") *with* J. BARROW, *supra* note 104, at 360. For discussions critical of the logic of Wheeler's approach, *see* J. LESLIE, *supra* note 95, at 93-95; J. POLKINGHORNE, *supra* note 96, at 24-25.

107. *See supra* notes 17-37 and accompanying text.

108. *See* Note, *supra* note 4, at 1968.

109. *See, e.g.*, A. ALTMAN, CRITICAL LEGAL STUDIES: A LIBERAL CRITIQUE 14-15 (1990); Fuller, *Playing Without a Full Deck: Scientific Realism and the Cognitive Limits of Legal Theory*, 97 YALE L.J. 549, 567-68 (1988); Herzog, *supra* note 8, at 628-29; Levit, *supra* note 1, at 286-87.

"indeterminacy jeopardizes any mode of objective decisionmaking"[110] and argues that "the law is irredeemably indeterminate."[111] In particular, "[w]ith imagination and industry, legal materials can be organized to support and justify incompatible outcomes."[112] Crucially, legal interpretation "can never be detached from the identities and interests of the interpreters."[113]

Now, a variety[114] of more and less[115] controversial indeterminacy claims can be formulated, not only by Critical Legal Studies adherents, but by "pre-Critical"[116] and contemporary "non-Critical" writers as well,[117] including even those associated with law and economics.[118] The inescapable variations among indeterminacy claims simply ensures that there can be no dramatic and unequivocal conclusion about what quantum indeterminacy says, if anything, about legal indeterminacy in general.

On the other hand, the relationship between particular theories of quantum indeterminacy and particular, concrete claims about some aspect of legal indeterminacy is a nearly inexhaustible subject. Among the most useful observations, though, are those "negative" observations addressing what quantum indeterminacy does not license in the legal realm. For example, it is unclear how quantum indeterminacy, on most views, provides any support for legal theories that necessarily

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110. Hutchinson, *Democracy and Determinacy: An Essay on Legal Interpretation*, 43 U. MIAMI L. REV. 541, 543 (1989).

111. *Id.*

112. *Id.* at 555. *See also* Solum, *On the Indeterminacy Crisis: Critiquing Critical Dogma*, 54 U. CHI. L. REV. 462, 462 (1987) (offering a similar initial generalized statement of what the indeterminacy thesis is thought to involve).

113. Hutchinson, *supra* note 110, at 543.

114. *Compare, id. with* D'Amato, *Can Any Legal Theory Constrain Any Judicial Decision?*, 43 U. MIAMI L. REV. 513, 513 (1989) (focusing on the indeterminacy of legal theories, as distinct from the indeterminacy of statutes, case law, rules, etc.). *See generally* Solum, *supra* note 112. For an example of a useful, narrow, more concrete indeterminacy claim, see M. TUSHNET, RED, WHITE AND BLUE: A CRITICAL ANALYSIS OF CONSTITUTIONAL LAW 15-16 (1988) (discussing the importance of the selection of the level of generality of analysis of a legal issue).

115. *See* Fuller, *supra* note 109, at 567-68; Herzog, *supra* note 8, at 628-29.

116. *See, e.g.*, Llewellyn, *Remarks On the Theory of Appellate Decision and the Rules or Canons About How Statutes Are to Be Construed*, 3 VAND. L. REV. 395 (1950) (developing a "moderate" indeterminacy thesis).

117. *See, e.g.*, Michelman, *Law's Republic*, 97 YALE L.J. 1493, 1528 (1988) ("The legal form of plurality is indeterminacy—the susceptibility of the received body of normative material to a plurality of interpretive distillations, pointing toward differing resolutions of pending cases . . . .").

118. *See, e.g.*, Posner, *Rebuttal to Malloy*, 24 VAL. U.L. REV. 183, 184 (1990) ("Once we get down to that genuine irreducible element of moral debate, I do not think economics will help; nor I think, will moral philosophy."). *See also id.* at 183 ("I do not think moral discourse is productive."). For a discussion of the allegedly more general indeterminacy of the economic analysis of law, *see* Hutchinson, *supra* note 110, at 561-67.

link indeterminacy in the law to a more or less politicized battle of conflicting interests.[119] Planck's constant itself, for example, has a single determinate value.[120] This value does not seem to be best explained on the basis of being chosen by dominant groups or coalitions because the value serves their distinctive interests.

Pragmatically, even if it served someone's interests to pretend that we could construct, or reconstruct, Planck's constant as larger or smaller than its present value, we would all soon run up against closed doors that used to be open. We simply do not have much choice in the matter. Either we adopt as the value of Planck's constant the value which nature regularly seems to suggest to us, or our theory-laden technological devices stop working.

This is of course not to minimize the role of conscious choice on some interpretations of quantum theory.[121] Whether an electron presents itself to us, for example, as a particle or as a wave may depend crucially on how we consciously choose to manipulate the experimental apparatus.[122] But even if, to choose another example, it is our conscious observation that collapses the superposed wave function of a simultaneously deceased-and-not-deceased cat into either a deceased cat, or else a live cat,[123] the actual determinate outcome does not flow from our perceived interests or preferences at the time of our observation. If the apparatus has been set up so that the cat has a fifty percent chance of survival as of the time we choose to collapse the wave function by observing the cat, then we get a live cat half the time (or in half the worlds), regardless of our interests or preferences concerning the status of the cat. We do not in this sense have the power to collapse superpositions in such a way as to make them come out the way we want, on particular occasions or even as a statistical matter over a run of trials, independently of how we have set up the experimental apparatus.

To the extent that a legal indeterminacy thesis suggests that in some or all cases persons making or influencing the decision can make that legal decision come out in such a way as to suit their interests or wishes by merely adopting one specific legal theory, there is less support for legal indeterminacy in the idea of quantum indeterminacy than we might initially have imagined.

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119. *See, e.g.*, Hutchinson, *supra* note 110, at 543. Of course, even if quantum theory does not support this legal thesis, the legal thesis may still be independently supportable.

120. *See supra* note 29.

121. *See, e.g.*, Mermin, *supra* note 49, at 397 ("We now know that the moon is demonstrably not there when nobody looks.").

122. *See supra* notes 38-43 and accompanying text.

123. *See supra* text accompanying notes 86-87; Rohrlich, *supra* note 49, at 563-64.

Indeterminacy theses in the law also naturally tend to impeach the idea of objectivity in the law.[124] Along with critical legal scholars, many feminist legal theorists have called the idea of legal objectivity into serious question.[125] While writers of varying approaches have joined in such a call,[126] focusing concretely on the feminist response to legal objectivity is useful. As we might suspect, not all feminists agree in their critique of objectivity, but skepticism as to claims of objectivity recurs.

Again, our focus must be not on whether any such critique of objectivity is ultimately on target, but whether such a critique is supportable through quantum theory. This is, itself, an almost inexhaustible issue. Certainly, on some interpretations of quantum mechanics, the distinction between subjective and objective is strongly impeached.[127] There are, however, limits to any quantum-based critique of objectivity. Nature still seems to present us with what we might call "objective hypothetical imperatives." If, for example, we choose to build quantum-based machines, we must not expect them to work as intended if we choose to pretend that Planck's constant should be given a numerical value hugely different from the value at which Planck arrived.[128] As long as we recognize this kind of truth, then wondering about whether statements about Planck's constant are in some sense "objectively" true loses much of its urgency.

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124. *See, e.g.*, R. UNGER, THE CRITICAL LEGAL STUDIES MOVEMENT 2-3 (1986); Hutchinson, *supra* note 110, at 543 ("Indeterminacy jeopardizes any mode of objective decisionmaking.").

125. *See, e.g.*, *Feminist Discourse, Moral Values, and the Law—A Conversation*, 34 BUFFALO L. REV. 11, 23 (1985) (Mackinnon comments that "[w]e are not allowed to question objectivity as the measure of what we know."); *supra* note 82, at 49 (Menkel-Meadow raises the possibility that at least some conceptions of "objectivity" may be distinctively male-associated); *supra* note 8, at 132 (Minow comments that feminists are questioning "the idea of one truth or one reality that can be discerned and agreed upon by all."); Minow, *Foreword: Justice Engendered*, 101 HARV. L. REV. 10, 33 (1987) ("No perspective asserted to produce 'the truth' is objective, but rather will obscure the power of the person attributing a difference while excluding important competing perspectives."); Scales, *supra* note 6, at 1378 ("Feminist analysis begins with the principle that objective reality is a myth."); *cf.* E. KELLER, REFLECTIONS ON GENDER AND SCIENCE 148-49 (1985) (questioning the rigidity of the distinction between subjective and objective, particularly in the context of modern physics).

126. *See, e.g.*, Callicott, *Intrinsic Value, Quantum Theory, and Environmental Ethics*, 7 ENVTL. ETHICS 257, 267 (1985) (quantum theory, together with other advances in twentieth-century science, has "forced the abandonment of the simple, sharp distinction between object and subject."); Posner, *supra* note 118, at 183-84 (questioning the objectivity of morality); Williams, *supra* note 17, at 441 ("Heisenberg's uncertainty principle suggest[s] that facts are no more objective than any theoretical construct."); Zimmerman, *Quantum Theory, Intrinsic Value, and Panentheism*, 10 ENVTL. ETHICS 3, 10-12 (1988) (responding to Callicott, supra).

127. *Cf.* H. PAGELS, *supra* note 11, at 65 ("The world just isn't 'there' independent of our observing it; what is 'there' depends in part on what we choose to see—reality is partially created by the observer."). *Cf.* Scales, *supra* note 6, at 1401 ("We do not separate the observer from the observed.").

128. *See supra* note 29.

Actually, it does not seem to be clear how philosophically deep the feminist critique of legal objectivity needs to go. Even the long and varied history of gender-based oppression through allegedly objectively true assertions does not by itself establish whether the ideal of aspiring to objective truth should be repudiated, purified and reformed, or taken seriously as a potentially progressive and liberating enterprise. Professor Ann Scales has written, for example, that "we must challenge the 'objective' standards which objectify us, which make us invisible and our history unimportant."[129] The very use of the scare quotes by Professor Scales rightly suggests that what is claimed to be objectively true can often be exposed as false and as irrationally exclusionary. In particular, the legal patterns to which Professor Scales objects can be shown to be objectively morally wrong.

Needless to say, the question of whether there are objectively right ways for men to behave toward women, or any objective rightness at all, is an important one.[130] There is obviously some risk in simply abandoning the ideal of objectivity, in that it then becomes difficult to show why individuals should, for example, recognize their own conduct to be oppressive, or cease their oppression, especially where such conduct is widely engaged in and appears to serve the interests of those engaging in such conduct.[131]

It may be possible, then, for feminists to hold open at least a redefined,[132] yet recognizable, sense of objective truth. This would allow the full significance of developments such as the rise of relational holism[133] in quantum mechanics to be realized. The assertion that quantum mechanics shows that "nature is on our side"[134] will not likely be practically significant in the absence of a recognizable concept of objectivity.

Of course, the discussion above in Section IV focuses not merely on the quantum mechanics of relational holism, which again may be wel-

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129. Scales, *supra* note 6, at 1376 n.15.

130. For a sense of the current status of the debate over the objectivity of morality, *see, e.g.*, D. BRINK, *supra* note 83; RELATIVISM: INTERPRETATION AND CONFRONTATION (M. Krausz ed. 1989); ESSAYS ON MORAL REALISM (G. Sayre-McCord ed. 1988); D. WONG, MORAL RELATIVITY (1984).

131. *See* Rhode, *supra* note 8, at 620 & n.10. One may wonder, incidentally, whether there are any leading critics of objectivity, of any school, who consistently avoid the temptation to use language that refers to, necessarily implies, or clearly trades upon traditional notions of objectivity.

132. *See* Scales, *supra* note 6, at 1402.

133. *See supra* notes 52-84 and accompanying text.

134. Scales, *supra* note 6, at 1401. Actually, Professor Scales makes this claim apparently not with reference to relational holism, but to "a less hierarchical structure, a multidirectional flow of authority" that "[n]ature itself has begun to evince." *Id.*

comed by many feminists,[135] but on the universality or near universality of that relational holism.[136] Admittedly, there is in much legal feminism an explicit distrust of at least some forms of the idea of universality.[137] But neither the idea of universality itself, nor the sort of universality associated with quantum relational holism seem to be the primary concern of feminist writers in this context. Rather, feminist concern focuses on what is referred to as "abstract universality,"[138] as opposed to concrete universality. Abstract universality is thought to be exclusionary, or to elevate what is distinctively male into an allegedly neutral, all encompassing norm.[139] Abstract universality may therefore amount only to a more or less avoidable biased or distorted form of genuine universality.

Universality, no less than objectivity, is unavoidably at best an aspirational ideal, and it seems true—objectively—that attempts at universality must to some degree be partial. The idea of universality admittedly has no doubt been, over the long term, a conceptual instrument of systematic abuse for repressive, inegalitarian ends. However, until it can be shown that the idea of universality itself, however recognizably revised or fulfilled, is unredeemable and necessarily destructive of women's interests, there does not seem to be any inherent conflict between the quantum mechanics of universal relational holism and feminist jurisprudence.

Feminists may remain concerned that while relationalism may, for whatever reasons, tend to be distinctively characteristic of women's values,[140] universalism tends to be particularly characteristic of male values.[141] If this is so, then the universal relational holism suggested by recent achievements in quantum mechanics may come to be seen as a natural and valuable developmental synthesis of patterns

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135. *See supra* note 82 and accompanying text.

136. *See supra* notes 80-81 and accompanying text.

137. *See* Cornell, *Toward a Modern/Postmodern Reconstruction of Ethics*, 133 U. PA. L. REV. 291, 299 (1985) (arguing for "a decentered subject, relational at its core," but without dissolving the self "totally in an all-encompassing community"); Menkel-Meadow, *supra* note 8, at 43, 48; Minow, *supra* note 125, at 45; Scales, *supra* note 6, at 1388; Sunstein, *supra* note 82, at 225.

138. *See* Cornell, *supra* note 137, at 293; Minow, *supra* note 125, at 45; Scales, *supra* note 6, at 1388.

139. *See* Cornell, *supra* note 137, at 293; Minow, *supra* note 125, at 45; Scales, *supra* note 6, at 1388; *see also* Sunstein, *supra* note 82, at 225 ("For feminists in particular, the problem is that universalist claims have tended to exclude women or to make women's claims appear deviant when measured against established norms.").

140. *See* Menkel-Meadow, *supra* note 82, at 43 (citing the research of educational psychologists).

141. *See id.*

characteristic of female and male reasoning.[142] Such a genuine synthesis seems attractive. In any event, it is not premature to begin the process of allowing developments such as universal relational holism to influence legal theory.

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142. *See id.* at 48 (suggesting, with certain qualifications, that moral maturity may involve the ability to synthesize characteristically female and male patterns of moral analysis).